

## CLAIMS

1. A control method of controlling a refrigeration cycle of an air conditioning system for a vehicle, which is equipped with a variable displacement compressor driven by an engine, the method comprising the steps of:
- determining a limit value of a discharge rate of the variable displacement compressor by an engine speed or a variable related to the engine speed; and
- controlling an operation of the variable displacement compressor on the basis of the limit value.
2. The control method of claim 1, wherein the limit value is determined by the engine speed and a load of ambient air.
3. The control method of claim 1, wherein the variable is a vehicle speed.
4. The control method of claim 3, wherein the limit value is determined by the vehicle speed and a load of ambient air.
5. The control method of claim 3, wherein the limit value is a smaller one of a limit value determined by the engine speed and another limit value determined by the vehicle speed.

6. The control method of claim 3, wherein the limit value is a smaller one of a limit value determined by both of the engine speed and a load of ambient air and another limit value determined by both of the vehicle speed and the load of ambient air.

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7. The control method of claim 1, further comprising the step of judging whether a cooling power of the air conditioning system is appropriate or not, wherein the operation of the variable displacement compressor is controlled in a manner that the discharge rate gets smaller when it is judged that the  
10 cooling power is excessive.

8. The control method of claim 1, wherein the air conditioning system is a CO<sub>2</sub> air conditioner.

15 9. A control device of controlling a refrigeration cycle of an air conditioning system for a vehicle, which is equipped with a variable displacement compressor driven by an engine, the control device comprising:

a limit-value determining unit for determining a limit value of a  
20 discharge rate of the variable displacement compressor by an engine speed or a variable related to the engine speed; and

a discharge-rate controlling unit for controlling an operation of the variable displacement compressor on the basis of the limit value.

10. The control device of claim 9, wherein the limit-value determining unit determines the limit value by the engine speed and a load of ambient air.
- 5 11. The control device of claim 9, wherein the limit-value determining unit determines the limit value by a vehicle speed.
12. The control device of claim 11, wherein the limit-value determining unit determines the limit value by the vehicle speed and a load of ambient  
10 air.
13. The control device of claim 11, wherein the limit-value determining unit determines the limit value by a smaller one of a limit value determined by the engine speed and another limit value determined by the vehicle  
15 speed.
14. The control device of claim 11, wherein the limit-value determining unit determines the limit value by a smaller one of a limit value determined by both of the engine speed and a load of ambient air and another limit  
20 value determined by both of the vehicle speed and the load of ambient air.
15. The control device of claim 9, wherein the limit-value determining unit judges whether a cooling power of the air conditioning system is appropriate and further changes a command value for the discharge-rate

controlling unit so that the discharge rate of the variable displacement compressor gets smaller when it is judged that the cooling power is excessive.

- 5 16. The control device of claim 9, wherein the air conditioning system is a CO<sub>2</sub> air conditioner.